Application of Chlorophyll Fluorescence in Selection of Crop Heat Tolerance

Min-Li Liu [1]

Abstract

The photosynthesis is critical to the matter conversion and energy metabolism of plants, however the directly and sensitively reacts to negative environment. Especially the heat stress shows more significant effects on the photosynthesis. The thylakoid membrane of chloroplast is vulnerable to high temperature which as a result lowers the efficiency of photosynthesis, and Photosystem II (PS II) is the most sensitive position reflecting heat stress. 'Fv' is the difference between the lowest to the highest luminescence; 'Fm' is the highest fluorescence value after exposed to saturated light source in the dark state. The ratio of Fv/Fm (the max. fluorescence value of PSII chemical reaction in the dark state) is an important parameter describing the physiological state of photosynthesis organelle and serve as an indicator showing the activity of photosynthesis through the evaluation of release amount of chlorophyll fluorescence. Under heat stress, the conduction of PSII electrons are affected so as to lower the ratio of Fv/Fm. Hence, in physiological study, the ratio is used as the indicator of the occurrence of heat stress. The responses of chlorophyll fluorescence in different heat stresses generally include rise of Fo(the min. fluorescence during the dark) and the fall of Fm (the max. fluorescence value under saturated light source in the illuminating state), and the drop of photo output and PSII efficiency. In heat stress, plants will show low seed germination rate, poor grain plumpness, low growth rate, and premature bolting, etc. Since the highest parameter of chlorophyll fluorescence (Fv/Fm) of corn leaves and ΦPS Ⅱ fall drastically and the non-photochemcial quenching coefficient, (qN) rises greatly in high

[1] Asistant Researcher, Kaohsiung District Agricultural Research and Extention Station, COA, EY.

temperature over 45℃, studying the change of various chlorophyll fluorescence parameters can be used to heat tolerant lines. The high heritability of leaf fluorescence is consistent under different heat stresses and shows high correlation to yield. With its advantages of easy operation, high sensitivity, and damage proof, the measurement of chlorophyll fluorescence can serve as the exciting energy of detecting photosynthesis organelle, and be used to observe the photosynthesis mechanism and regulation and select the environmental tolerance of crops, such as high and low temperature, drought, high lighting, and potential production.

Keywords: photosynthesis, heat stress, chlorophyll fluorescence.